In these days of renewed interest in the establishment of physical laboratories, it is interesting to read Maxwell's views of the best method of conducting these laboratories. In a letter to Mrs. Maxwell, he says in regard to the Cavendish laboratory at Cambridge, —

"There are two parties about the professorship: one wants popular lectures, and the other cares more for experimental work. I think there should be a gradation, — popular lectures and rough experiments for the masses, real experiments for real students, and laborious experiments for first-rate men."

Rarely has the true solution of the problem of the proper course in the direction of a laboratory been more clearly stated.

Many who know nothing of the nature of the studies to which Maxwell devoted his life, will read his life, and find it a fascinating one. The philosopher will ponder over the views of the structure of the universe, and Maxwell's endeavor to do his duty in a world some of whose mysteries he set himself to discover. The physicist will find it easier to read the treatise on heat, and the treatise on electricity and magnetism, by becoming better acquainted with the habits of thought of Maxwell as they are revealed by his own letters in this little volume. The devout Christian will find in Maxwell an exemplar to whom he can point with unanswerable words as an illustration of the satisfying power of the Christian faith to a mind which has had few equals in the history of the world, and which, nevertheless, clung to the Christian religion as the only satisfying thing in the end.

THE PART PLAYED BY THE CELL IN LIVING ORGANISMS.

LIKE most other new doctrines, the cellular theory has been given too wide an interpretation. Within the last few years, botanical research has proved that the essential living part, the protoplasm, is often united by slender threads passing from cell to cell. A similar connection has also been demonstrated in certain animal organs. Nevertheless, 'cells' remain actual facts, and very important facts, of which the biologist has to take account. The cellular theory may be modified in detail, but it will remain true in essentials. With regard to certain cells, even in the highest animals, as the amoeba-like corpuscles which creep all over our own bodies in the lymph-channels, and play an important part in the regeneration of injured tissues, it is certainly true, even in its most extreme form. At this critical epoch in its history, a brief account of the development of the cell-doctrine may be of interest. We condense it from the pages of Canon Carnoy.

La biologie cellulaire: étude comparée de la cellule dans les deux regnes. Par le Chanoine J. B. CARNOY, professeur à l'université catholique de Louvain. Lierre, *Joseph Van In et cie.*

Robert Hooke (1665) first applied the word 'cell' in describing the structure of plants. He did not, however, regard cells as separate pieces of living matter, but compared them to cavities in a continuous mass, like the cells of a honeycomb. Malpighi (1675) recognized that vegetable cells were distinct, apposed, closed sacs. Leeuwenhoek, in his letters to the Royal society of London (1680–95), called especial attention to the cell-membrane or envelope. From this time, for about one hundred years, vegetable cells (animal being unknown) were regarded as little bladders filled with a homogeneous liquid.

The next advance was made in 1781, when Fontana described and figured within some cells an 'oviform body provided in the centre with a spot.' This earliest observation of the cell-nucleus remained practically unheeded for fifty years, and then R. Brown of Oxford confirmed and greatly extended it. He first demonstrated that the nucleus was a normal and usual constituent of vegetable cells. The 'spot' inside the nucleus seen by Fontana, and now known as the *nucleolus*, was rediscovered by Valentin in 1836. At this epoch, therefore, the *cell* was defined as "a vesicle with a solid envelope, containing liquid in which a nucleus with its nucleolus floated." Starch grains, chlorophyl bodies, and crystals had also been seen in various cells.

The next step forward was the recognition of cells as independent individuals, or 'elementary organisms.' Turpin and Mirbel promulgated this view about 1826; but it was Schleiden's 'Grundzüge der wissenschaftlichen botanik' (1842) that led to any general acceptance of it by scientific men. Since then, Schwann, Max Schultze, Brücke, and many others, have firmly established it.

Meanwhile, the relation of cells to the large plants in which they were found, was being studied. Malpighi and Leeuwenhoek both believed that such plants were essentially made up of juxtaposed cells. Schleiden and others, especially Hugo von Mohl (1827), finally demonstrated that vegetable tissues, as a whole, were but aggregates of more or less modified cells, which had a common origin, and were all at first alike, but often became greatly altered in the growth and development of the plant.

About 1830 the cell-doctrine was accepted, so far as concerned the vegetable kingdom. That it was also applicable to animals, was stated by Dutrochet in 1824; but it remained for Schwann to prove in his classical treatise (1839) the correctness of this thesis. From that time the cellular theory may be regarded as definitely established. Its extension to the explanation of certain pathological processes by Goodsir (1845) and Virchow (1859) was a noteworthy advance.

All this time the definition of the cell, accepted at the time of Valentin's work, was undergoing modification. The protoplasm was discovered, and its fundamental importance recognized. Bit by bit the essential structure of cells was simplified, until now the term denotes nothing but an independent particle of protoplasm. This particle may have, and often has, a nucleus in it, and a cell-wall around it; but both may be absent, and the tiny mass live and grow and multiply. Such modifications, in our conceptions as to what parts are necessary to the construction of a cell, do not, however, in any way essentially alter the cell-doctrine: it still remains a fundamental truth, the basis of all morphology and physiology.

Of late years a vast number of important papers have appeared, dealing with the structure and the properties of cells. They are scattered over the pages of many journals, and written in many languages; and the time had come for some one to collect and unify them. A good summary of the more important results of the work of the past twenty years, and a bibliography, aiding those desiring more detailed information to find it in original sources, was a necessity. Canon Carnoy undertook this task; and, so far as the present fascicule of his treatise on the 'Cellular biology' goes, has performed it well. The instalment published contains two hundred and seventy-one pages, of which, however, only the final hundred deal directly with cells. The introductory pages contain an exposition of the objects and methods of education, which we heartily commend to all teachers of natural history; also directions in histological technique, which, for students of general biology, are more useful than those in any text-book of microscopy with which we are acquainted.

The subjects discussed in the final hundred pages are as follows: discovery of the cell and of its parts; elementary organisms; the cellular biology; protoplasm; the properties of living matter; the general structure of the cell, and its newer definitions; the structure and general composition of protoplasm and nucleus; the general laws of the cell; the structure and composition of the nucleus in detail. The last topic occupies more than sixty pages. and is of great value as bringing together in convenient form the main results of the many researches on nuclei made during the last ten years.

An important and gratifying feature of the book is that its illustrations are not only good, but new. It is difficult to express fully our gratitude for this: those who have been wearied by seeing the same veteran woodcuts dragged out once more for duty in each new text-book, will, however, appreciate the gladness with which we greet these new, and in most cases better ones.

While we heartily commend Canon Carnoy's book for its scientific merits, we think that it has another claim to the attention of all who are interested in the progress of human thought: it marks the close of an epoch. Written by a professor in a Catholic university, in a Catholic country, and utilizing and accepting as it does the results attained by the best biological workers and thinkers independently of all theological prejudice, it is a sign, among many, that modern biology has won its battle. There will still be occasional echoes of the struggle, and we may for some time to come meet such instances of persecution as that to which Professor Woodrow was recently subjected; but the war is over. The religious world in general recognizes daily with greater clearness that science is not necessarily irreligious; and that the conviction that our universe has been developed and is governed in accordance with immutable laws, is compatible with belief in an all-wise Law-giver.

LANGLEY'S WORK ON MOUNT WHITNEY.

FROM a scientific point of view, the 'Report of the Mount Whitney expedition of 1881' is unquestionably one of the most important volumes which has ever been issued by our government. It presents fully and clearly, not only the observations made upon the mountain, with their results, but also much of the preliminary work and discussion which showed the need of such an expedition, together with a description of the ingenious and delicate apparatus devised by Professor Langley for the investigation.

Researches on the solar heat, and its absorption by the earth's atmosphere. A report on the Mount Whitney expedition. By Prof. S. P. LANGLEY. Washington, *Government*, 1884. (Prof. papers U. S. signal serv., xv.) 242 p., illustr., 21 pl., map. 4°.